

A RECONSIDERATION OF THE NOMENCLATURE AND
TAXONOMY OF THE *FESTUCA ALTAICA* COMPLEX
(POACEAE) IN NORTH AMERICA

VERNON L. HARMS

The W. P. Fraser Herbarium and Biology Department,
University of Saskatchewan,
Saskatoon, Saskatchewan S7N 0W0, Canada

ABSTRACT

The recent taxonomic treatment of the North American members of the *Festuca altaica* complex by Looman (1979) is briefly reviewed and some nomenclatural problems are discussed. The nomenclatural histories of the included taxa are briefly summarized, and a revised taxonomic treatment is presented, recognizing three subspecies within the complex in North America, and including *F. altaica* subsp. *hallii*.

In Budd's Flora of the Prairie Provinces, Looman (1979) presented a revised taxonomic treatment, including some major taxonomic and nomenclatural changes, for the ecologically important *Festuca altaica* complex (rough-fescues) in North America. This was offered with minimal explanation. Although further elaboration may still be forthcoming from the author, four years have passed with only an unexplained nomenclatural correction (Looman 1981). Meanwhile, several comments with regard to this recent "revision" seem pertinent lest Looman's changes be too uncritically accepted.

Looman (1979) recognized three separate North American species in the *Festuca altaica* complex, as follows: (1) *F. altaica* Trinius of central to northeastern Asia and northwestern North America, occurring on this continent in the Alaskan and northern Rocky Mountains (= *F. altaica* sensu stricto of other treatments); (2) "*F. doreana* Looman" (a name that has never been validly published and that was replaced by *F. campestris* Rydb. without explanation in the "reprint" of Budd's Flora [1981]), applying to a species of the somewhat more southern Rocky and Cascade Mountains and foothills (*F. scabrella* var. *major*, *F. altaica* var. *major*, *F. scabrella* sensu lat., or *F. altaica* subsp. or var. *scabrella* sensu lat. of other modern treatments); and (3) *F. hallii* (Vasey) Piper, a species of the Northern Great Plains grasslands, extending southward to Colorado along the eastern foothills of the Rocky Mountains (= *F. scabrella* s. str., or *F. altaica* subsp. or var. *scabrella* of most other modern treatments). Looman's (1979) treatment contrasts with that of most other modern authors, who have recognized the latter two taxa as conspecific, either varietally distinguished or not, under *F. scabrella* Torrey, or

else as one subspecies or two varieties of a more comprehensive *F. altaica*. The western mountain variant with larger, 3–5-floreted spikelets, unequal glumes, and taller culms (within the usually accepted North American species, *F. scabrella* sensu lat.), has often been distinguished as var. *major* Vasey (=“*F. doreana*” and *F. campestris* sensu Looman 1977 and 1981, respectively), leaving the typical varietal epithet, *scabrella*, to refer to the northern Great Plains taxon (= *F. hallii* sensu Looman), with smaller, 2–3-floreted spikelets, sub-equal glumes, and shorter culms. Treated under an all-inclusive *F. altaica*, the two variants have either been merged under *F. altaica* subsp. *scabrella* (Torrey) Hultén or distinguished as *F. altaica* var. *major* (Vasey) Gleason and var. *scabrella* (Torrey) Breitung, respectively.

Looman's (1979) quite significant taxonomic revision of the North American members of the *Festuca altaica* complex represents an innovative contribution towards a better understanding of the morphological variations and taxonomic distinctions within this group. Presented therein for the first time are various clarifying taxonomic differences that are potentially useful in separating the included taxa of this complex. Unfortunately, because of its concise and unelaborated presentation in manual format, submerged within this regional flora, Looman's treatment of this group may easily be overlooked by interested agrostologists, plant taxonomists and ecologists.

Nevertheless, despite its value as a useful taxonomic contribution, there are some nomenclatural problems in Looman's (1979 and 1981) taxonomic treatment of the rough-fescue complex. In the first place, the name “*Festuca doreana* Looman” was not validly published in the original (1979) printing of Budd's Flora, nor has it been validated since. Latin diagnosis (as required under Article 36.1 if it was intended as a new species description) and bibliographic data for the cited synonym “*F. scabrella* var. *major* Vasey” (as required for a basionym under Articles 32.1 and 33.2 of the International Code of Botanical Nomenclature) are lacking. Furthermore, the name “*F. doreana*” would have been nomenclaturally superfluous even with the latter data, because it would have been based on the same basionym (viz. *F. scabrella* var. *major* Vasey, Contr. U.S. Natl. Herb. 1:278–279, 1897) as was the earlier species name, *F. campestris* Rydberg [Mem. N.Y. Bot. Gard. 1:57, 1900]. If the even older specific name, *Festuca scabrella* Torrey, should be ruled out as not applicable to this taxon of the Rocky and Cascade Mountains, as Looman (1979) did, then the next in priority is *F. campestris* Rydberg. There appears no valid reason to exclude the latter name, since Rydberg (1900) seems clearly to have based it on *F. scabrella* var. *major* Vasey, simultaneously citing as a usage synonym, “*F. scabrella* Coulter, Man. R.M., 424, not Torr.”

Looman must have recognized the unacceptability of the name,

"*F. doreana*," as shown by his substitution of the name *F. campestris* in the second printing (1981) of Budd's Flora and the use of the latter name in Looman (1983), although no nomenclatural explanations were given in either case. I believe that the still older specific name, *F. scabrella*, has priority over *F. campestris* for this western mountain taxon because Drummond's type material of the former appears best referred here. Looman (1979) evidently considered it necessary to find a new name for this taxon because of his view that the type of *F. scabrella* Torrey was referable instead to *F. altaica* s. str. He gave no explanation for this dispensation, which was reminiscent of the much earlier, similar referral by Piper (1906).

The taxonomic placement of Thomas Drummond's type material of *F. scabrella* Torrey is critical to the nomenclature of this group. An examination of the "Ex Herb. Torrey" holotype (now at GH), and the original "Gray Herb.!" isotype (also at GH) appeared readily enough to preclude their identification as the northern Great Plains–Eastern Foothills taxon, *F. hallii* sensu Looman because of the distinctly unequal glumes and the spikelets mostly with 4 florets and exceeding 8 mm in length. Furthermore, the leaves of the "Ex Herb. Torrey" holotype specimens varied from 1.5 to 2.5 mm wide and were only loosely involute, although the leaves on the "Gray Herb.!" isotype were more strongly involute. Unfortunately the quality of the type materials was too inadequate and the spikelets too immature to assure their unequivocal identification as either *F. altaica* sensu str. or the more southern mountain taxon that Looman called "*F. doreana*" (in 1979) and *F. campestris* Rydb. (in 1981). Most of the individual plants appeared depauperate for either taxon, and had rather scanty panicles. Coloration of herbage and spikelets was obscure. Although measurements of the lengths of spikelets, glumes and lemmas fell more into the expected range for *F. altaica* sensu str. than for the more southern mountain taxon, these are questionably reliable for the particular maturation stages. The rather contracted panicles with mostly ascending-erect upper branches, on the other hand, suggested the latter, as did the relatively inconspicuous glume-borders. Thus, identification of the available type material seemed inconclusive, although I was most inclined to place it with the more southern mountain taxon *F. campestris* sensu Looman 1981.

Neither does the original diagnosis in Hooker (1840) give conclusive clues to the proper taxonomic placement of the *F. scabrella* type material. The unequal glumes, 3–4-floreted spikelets, nearly glabrous and only loosely involute leaves, and (lower?) panicle branches spreading, would seem to exclude the northern Great Plains taxon, *F. hallii*, and rather imply either *F. altaica* s. str. or the more southern mountain taxon that Looman called "*F. doreana*" and *F. campestris* (in 1979 and 1981).

The spikelet size described as 0.75 in. (= 1.9 cm), and the "upright" and "erect" panicles, seem best referable to the more southern mountain taxon, but the "purplish-green" spikelet color suggests *F. altaica* sensu str. Neither panicle shape nor spikelet color, however, seem very reliable diagnostic characters. The considerable emphasis given to the scabrous lemmas, leaf-sheaths, and culms, in the original species description, now seems unwarranted because such more or less pubescent forms occur in each of the three presently recognized taxa. *Festuca hallii* has the most consistently pubescent leaf-sheaths.

The taxonomic placement of Thomas Drummond's type collection of *F. scabrella* Torrey can be clarified by reference to its geographical source. Drummond's type was collected in 1825 or 1826, on the John Franklin Second Expedition, and is listed in Hooker (1840) as from "alpine districts of the Rocky Mountains." There has been frequent difficulty in confidently determining the locality, elevation, and habitat of many Drummond collections. But with the specimen label data and notations in Hooker (1840), supplemented by information from Drummond's own travel accounts (Drummond 1827, 1830; and in Franklin 1928, pp. 308-313), especially as clarified by the chronological and geographical tracing of his expedition by Bird (1967) and Ewan and Ewan (1981, pp. 63-64), it can be concluded with some confidence that Drummond's "Rocky Mountain" collections labelled as above came from the present-day Jasper National Park region. Drummond's collections from this region apparently ranged from "Jasper House" (53°20'N, 117°51'W), Rock Lake (called "Lac-la-Pierre" (53°27'N, 118°16'W), and the length of the Snake Indian (called "Assinaboyné") River (ca. 53°10'-22'N; 118°00'-50'W), southward along the upper Athabasca River (called "Red-Deer River, one of the branches of the Athapescow") to its headwaters near the Columbia Ice Fields (53°13'-25'N, 117°15'-20'W) and up the Whirlpool River toward Athabasca Pass (at 52°23'N, 118°11'W), on the Columbia Portage.

The collections made on Drummond's side-expedition northwestward to the headwaters of the Peace River in September 1826, seemingly were labelled from "north of Smoking (=Smoky) River" and/or "lat. 55°" or "lat. 56°." His collections from Athabasca Pass itself, in October 1826, appear labelled, "height of land," "summit" or "near summit of Rocky Mountains." His British Columbian collections, made during his brief October 1826 expedition through and southwest of Athabasca Pass along the Wood (called "Portage") River to the Columbia River, apparently bore the labels "Grande Cote," "Portage (River)," "sources of the Columbia," "the Columbia (River)" or "west side of the Rocky Mountains." Thus, at least tentatively discounting those Rocky Mountain collections by Drummond from the Peace River, Athabasca Pass and British Columbia, all presumably bearing the special label notations indicated above,

the type locality of *F. scabrella* can be narrowed down with considerable assurance to the east (i.e., Alberta) side of the Continental Divide and to within the coordinates: 52°15'–53°30'N and 117°15'–118°50'W.

Interestingly, the presumed type locality of *F. scabrella* falls within the overlapping known ranges of the taxa that Looman (1981) called *Festuca hallii* and *F. campestris*, and somewhat less than 100 miles south of the known range of *F. altaica* sensu str. (as I interpret these three taxa). In this general area of east-central British Columbia and west-central Alberta, the three taxa are characteristic of lower, middle and high mountain elevations, respectively, so the altitudinal placement of the type collection of *F. scabrella* assumes importance. But, as his botanical colleague, John Richardson (1851, Pt. 3, p. 521), pointed out, "It is unfortunate that the vertical limits of the species gathered by Drummond in the mountains were not better noted . . . (as that) would have conveyed much information with respect to the distribution of plants." The habitat notation in Hooker (1840), "alpine districts," is not as unequivocal as it at first might seem. The word "alpine" was used frequently for Drummond collections in Hooker (1880) in references to "alpine woods," "marshes," etc., habitats, sometimes in apparent contrast to "open elevated places," "summits," or "barren places," and at other times in apparent contrast to "mountain woods." So the notation of "alpine districts" for Drummond's collections does not necessarily, if at all, imply an alpine tundra habitat at high elevations above tree-line, but quite possibly a sub-alpine zone. The habitat indication, "alpine districts," given in Hooker (1840) may also be queried because such a notation was not included on Drummond's exsiccatae labels.

The cumulative evidence from the characteristics of the type materials available of *Festuca scabrella* (viz., the holotype and an isotype, both in GH), the original species diagnosis, and the presumed geographical location and possible habitat of the type collection, allows its most likely, although still somewhat tentative, referral to the larger more southern mountain taxon that Looman called *F. campestris* Rydb. (in 1981). Such a taxonomic placement of the type material, would give the name *F. scabrella* Torrey priority over *F. campestris*.

Acceptance of these conclusions concerning the type of *F. scabrella* raises a nomenclatural problem with respect to the most frequent traditional taxonomic treatment (although not Looman's) that has recognized the two varieties, *scabrella* and *major*, within *F. scabrella*. A problem results because the names, *F. scabrella* Torrey (in Hooker, Fl. Bor.-Am. 2, 252, 1840; type from alpine districts of the Rocky Mountains, Canada, *Thomas Drummond s.n.*) and *F. scabrella* var. *major* Vasey (Contrib. U.S. Natl. Herb. 1:278–279, 1897; type from Spokane Co., Washington, *Suksdorf 118*), are both based

on type specimens that are interpreted as belonging to the more southern Rocky and Cascade Mountain taxon rather than to the northern Great Plains–Eastern Foothills taxon. If the latter is recognized as distinct from the former, the epithet *scabrella* is unavailable for it. For this reason, rather than because of Looman's (1979) referral of the *F. scabrella* type to synonymy under *F. altaica* sensu str., I concur with Looman's substitution of the epithet *hallii*, which is based on *Melica hallii* Vasey (Bot. Gaz. 6:296, 1881; lectotype [indicated by Piper, 1906] from northern Colorado, *Hall and Harbour 621* [US]). Upon examination of the lectotype of *F. hallii* and duplicates of it, as well as several later collections by W. A. Weber et al. from Larimer and Huerfano Counties, Colorado, it seems apparent that all of these do indeed belong to the same taxon as does the rough-fescue of the northern Great Plains and Eastern Foothills grasslands. This identification seems definite despite their rather surprising occurrence at high alpine-meadow elevations. Some short rhizomes are even evident on the type materials, a taxonomic characteristic also noted by Weber (1961) on his Colorado collections.

Aside from the nomenclatural problems, Looman's recognition of the three taxa within the North American *F. altaica* complex seems basically well conceived and acceptable, although not necessarily with these variants treated as species. If they were to be treated as distinct species, the appropriate names for the (1) Beringian, (2) more southern Rocky and Cascade Mountain, and (3) northern Great Plains taxa of the rough-fescue complex as distinguished by Looman, would be, respectively: (1) *F. altaica* Trinius, (2) *F. scabrella* Torrey and (3) *F. hallii* (Vasey) Piper. If distinguished at the varietal level, the appropriate names would be, respectively: (1) *F. altaica* Trinius var. *altaica*, (2) *F. altaica* var. *major* (Vasey) Gleason, and (3) *F. altaica* var. *hallii* (Vasey), a combination that has never been made.

Recognition of these taxa at the subspecific level seems most preferable, however, for the following reasons. Although I agree that three North American taxa are at least broadly distinguishable within the *F. altaica* complex, personal experience in both field and herbarium strongly suggests to me that these are rather less discrete than is implied by Looman (1979). In many specimens, especially those from the mid-latitude (circa 49°–55°) in the Rocky Mountains and eastern foothills, the characters that distinguish the taxa may often appear overly subtle or seemingly intergradient. Thus it would seem preferable to accept these taxa at an infraspecific rather than a specific level. On the other hand, despite evidences of apparent intergradation (i.e., the presence of morphological intermediates), they occupy broadly separate geographical ranges for the most part.

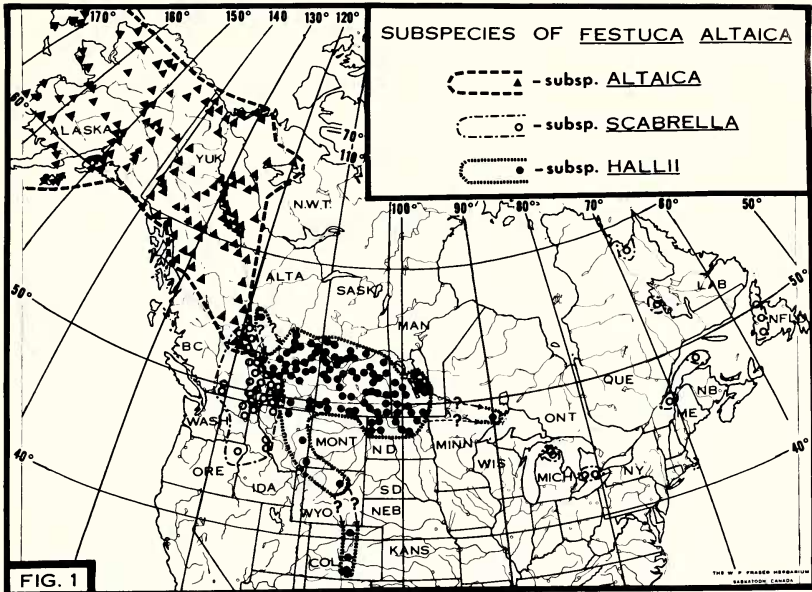


FIG. 1. Distribution of the subspecies of *Festuca altaica* Trin. in North America.

The recognition of these taxa at a subspecies rank seems most appropriate.

The following taxonomic treatment (viz., key and nomenclatural summaries) is presented for *Festuca altaica* sens. lat. in North America, based largely on the diagnostic criteria given by Looman (1979), to distinguish and circumscribe the three recognized taxa, but at a subspecific level. The generalized distributional information appended for each taxon, and forming a partial basis for the ranges given in Fig. 1, has been extracted from Johnson (1958) and Hitchcock (1950), and a variety of regional floras including Gleason (1952), Harrington (1954), Scoggan (1957, 1978), Hultén (1968), Hitchcock et al. (1969), Voss (1972), Taylor and MacBryde (1977), Cronquist et al. (1977), McGregor et al. (1977), Porsild and Cody (1980), Boivin (1981), and Packer (1983), and from the numerous herbarium specimens personally reviewed.

Key to Subspecies of *Festuca altaica* in North America

1. Plants tufted, not at all rhizomatous; culms often over 6 dm high; spikelets over 10 mm long; fertile florets 3–6 per spikelet; glumes distinctly unequal, the first glume distinctly shorter than the first lemma; leaf-blades either flat or involute, 7-nerved; at least the

lower panicle branches spreading to somewhat reflexed or \pm ascending.

2. Culms (3-)4-6(-8) dm high; herbage yellowish to dark-green; spikelets often \pm reddish, (8-)9-13 mm long, with 3-5 florets; glumes with conspicuous translucent borders; lemmas 5-8 mm long; leaf-blades 1-2.5 mm wide; panicles open, lax, \pm ovoid, with longer, spreading, and weaker branches, often \pm secund subsp. *altaica*
2. Culms (3-)5-10 dm high; herbage more grayish to bluish-green; spikelets mostly green to stramineous, (8-)10-16 mm long, with 4-6 florets; glumes with less conspicuous translucent borders; lemmas 6-9 mm long; leaf-blades (1-)1.5-3 (-4) mm wide; panicles tending to be more erect, contracted, stiffer and narrower, not at all secund subsp. *scabrella*
1. Plants less strongly tufted, somewhat rhizomatous and mat-forming; culms 2-6 dm high; spikelets mostly green to stramineous, 7-8 mm long; florets 2-3 per spikelet, the 3rd often sterile; glumes subequal, about equal to the first lemma; leaf-blades involute, less than 1.5 mm wide, obscurely 5-nerved; the lower panicle branches more strongly ascending to contracted-appressed subsp. *hallii*

1. *FESTUCA ALTAICA* Trinius subsp. *ALTAICA*. "Northern Rough Fescue."—*F. altaica* Trinius in Ledebour, Fl. Altaica, 1:109-110. 1829.—TYPE: Central Asia, Altai Mts.: "In summa alpe ad fontem fl. Acjulac rarissima," (tr.: "Very rare on mountain summit at source of Acjulac River"), *C. B. Trinius* (Holotype: LE).

Distribution. e.c.-n.e. Asia; Alaska, Yukon, w. Mack. Distr., s. to n. B.C. and in Rocky Mts. to e.c. B.C. and w.c. (and n.w.?) Alta.

2. *FESTUCA ALTAICA* Trinius subsp. *SCABRELLA* (Torrey) Hultén. "Mountain Rough Fescue."—*F. scabrella* Torrey, in Hooker, Flora Boreali-Amer. 2:252. 1840.—*F. altaica* subsp. *scabrella* (Torrey) Hultén, Flora Alaska and Yukon, v. 2, p. 241. 1942.—*F. altaica* var. *scabrella* (Torrey) Breitung, Amer. Midl. Naturalist 58:12. 1957 (as to basionym, not concept).—"*F. altaica* forma *scabrella* (Torrey) Looman," Budd's Flora Can. Pr. Prov., p. 128. 1979 (as to basionym, not concept; non rite publ.).—TYPE: Canada: "Alpine districts of the Rocky Mountains," 1827, *T. Drummond s.n.* (Holotype: the "Ex Herb. Torrey" specimen now at GH!; isotypes: the "Gray Herb.!" specimen at GH!; BM).
- F. scabrella* var. *major* Vasey, Contr. U.S. Natl. Herb. 1:278. 1893.—*F. altaica* var. *major* (Vasey) Gleason, Phytologia 4:21. 1952.—*F. campestris* Rydberg, Mem. N.Y. Bot. Gard. 1:57. 1900 (basionym: *F. scabrella* var. *major* Vasey).—"*F. doreana* Looman,"

Budd's Flora Can. Pr. Prov., pp. 128–129. 1979 (basionym indicated as *F. scabrella* var. *major* Vasey; non rite publ.).—
TYPE: USA: Washington: Spokane Co.: “on prairies,” 1884, *Suksdorf 118* (Holotype: US!).

Distribution. Rocky Mts. of w.c.-s.w. Alta., e.c. and s. B.C., s. in Rocky and Cascade Mts. to e. Ore., s. Ida., and w. Mont.; disjunct eastern isolates in Great Lakes region (n. Mich. and s. Ont.), the Gaspé Peninsula region (e. Que.), e.c. Que. (and w.c. Lab.?), Ungave Bay (n. Que.), and w. Newfoundland. The Michigan and e. Canadian disjunct populations of this complex seem best referred, at least tentatively, to subsp. *major*, but this conclusion needs verification, especially since, for reasons of geographical proximity, subsp. *hallii* might seem the more likely taxon to occur there. Yet the phytogeographical pattern of Cordilleran taxa with such eastern isolates is well known for various other groups.

3. *FESTUCA ALTAICA* Trinius subsp. *hallii* (Vasey) Harms comb. nov. “Plains Rough Fescue.”—*Melica hallii* Vasey, Bot. Gaz. 6:296. 1881.—*Festuca hallii* (Vasey) Piper, Contr. U.S. Natl. Herb. 10: 31. 1906.—*F. altaica* subvar. *hallii* (Vasey) St. Yves, Candollea 2:271. 1925.—*F. scabrella* subsp. *hallii* (Vasey) W. A. Weber, Univ. Colo. Stud., Ser. Biol. 7:8. 1961.—TYPE: USA, Rocky Mountains, northern Colorado, Lat. 39°–40°, 1862, *Hall and Harbour 621* (Lectotype [as indicated by Piper, Contr. U.S. Natl. Herb. 10:31. 1906]: US!; isolectotypes: US–3!, F–photograph!).

F. scabrella auct. pro parte, non Torrey.

Distribution. This is the rough fescue variant of the northern Great Plains grasslands and parklands (w. Alta., c. Sask., to s.e. Man. and n.w. Dak.), apparently disjunct near Thunder Bay, Ont., extending s. along the eastern foothills of the Rocky Mts. in Mont. and Wyo., to s.c. Colo. (in Colorado, at high elevations, rare, and perhaps disjunct, as suggested by Weber, 1961).

LITERATURE CITED

- BIRD, C. D. 1967. The mosses collected by Thomas Drummond in Western Canada, 1825–1827. *Bryologist* 70:262–266.
- BOVIN, B. 1981. Flora of the prairie provinces, Part 5—Gramineae. Mem. de l'Herbier Louis-Marie, Université Laval, Québec.
- CRONQUIST, A., A. H. HOLMGREN, N. H. HOLMGREN, J. L. REVEAL, and P. K. HOLMGREN. 1977. Intermountain flora, Vol. 6. New York Bot. Garden.
- DRUMMOND, T. 1827. Letters (from Drummond). *Linnaea* 2:519–525.
- . 1830. Sketch of journey to the Rocky Mountains and to the Columbia River in North America. *Hooker's Bot. Misc.* 1:178–219.
- EWAN, J., and N. D. EWAN. 1981. Biographical dictionary of Rocky Mountain naturalists. Bohn, Scheltema, and Holkema, Utrecht/Antwerpen.

- FRANKLIN, JOHN. 1828. Narrative of a second expedition to the shores of the Polar Sea in the years 1825, 1826, and 1827. Charles E. Tuttle Co. Rutland, VT.
- GLEASON, H. A. 1952. The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada. New York Botanical Garden, NY.
- HARRINGTON, H. D. 1954. Manual of the plants of Colorado. Sage Books.
- HITCHCOCK, A. S. 1950. Manual of the grasses of the United States (2nd ed., rev. by A. Chase). USDA Misc. Publ. 200.
- HITCHCOCK, C. L., A. CRONQUIST, M. OWNBEY, and J. W. THOMPSON. 1969. Vascular plants of the Pacific Northwest, Part 1. Univ. Wash. Press.
- HOOKER, W. J. 1840. Flora Boreali-Americana, Vol. 2. H. G. Bohn, London.
- HULTÉN, ERIC. 1968. Flora of Alaska and neighboring territories. Stanford Univ. Press, Stanford, CA.
- JOHNSTON, ALEXANDER. 1968. Note on the distribution of Rough Fescue (*Festuca scabrella* Torr.). Ecology 39:536.
- LOOMAN, J. 1979. *Festuca*, fescue. In J. Looman and K. F. Best, Budd's Flora of the Canadian prairie provinces, pp. 127-132. Research Branch, Agriculture Canada, Publ. No. 1662.
- . 1981. *Festuca*, fescue. In J. Looman and K. F. Best, Budd's Flora of the Canadian prairie provinces, pp. 127-132. Research Branch, Agriculture Canada, Publ. No. 1662. (Reprint with corrections of 1979 publication.)
- . 1983. 111 range and forage plants of the Canadian prairies, Publ. No. 1751, Agriculture Canada, Research Branch, Ottawa.
- MARIE-VICTORIN, FRÈRE. 1964. Flore Laurentienne. Université de Montréal, Montréal, PQ.
- MCGREGOR, R. L., T. M. BARKLEY, et al. 1977. Atlas of the flora of the Great Plains. Iowa State Univ. Press, Ames.
- PACKER, J. G. 1983. Flora of Alberta, 2nd ed. Univ. Toronto Press, Toronto.
- PIPER, C. V. 1906. North American species of *Festuca*. Contr. U.S. Natl. Herb. 10: 1-48.
- PORSILD, A. E. and W. J. CODY. 1980. Vascular plants of the continental Northwest Territories, Canada. Natl. Mus. Nat. Sci., Ottawa.
- RICHARDSON, JOHN. 1851. Arctic searching expedition: a journal of a boat-voyage through Ruperts Land and the Arctic Sea in search of the Discovery ships under command of Sir John Franklin. Longman, Brown, Green and Longmans, London.
- RYDBERG, P. A. 1900. Catalogue of the flora of Montana and the Yellowstone National Park. Mem. N.Y. Bot. Gard. 1: (No. 3835).
- SCOGGAN, H. J. 1957. Flora of Manitoba. Natl. Mus. Canada, Ottawa.
- . 1978. The Flora of Canada, Part 2—Pteridophyta, Gymnospermae, Monocotyledonae. Natl. Mus. Canada, Ottawa.
- TAYLOR, R. L. and B. MACBRYDE. 1977. Vascular plants of British Columbia, — A descriptive resource inventory. Techn. Bull. No. 4, The Botanical Garden, Univ. British Columbia.
- VASEY, GEORGE. 1881. Some new grasses. Bot. Gaz. 6:296-298.
- . 1893. Descriptions of new or noteworthy grasses from the United States. Contr. U.S. Natl. Herb. 1:267-280.
- VOSS, E. G. 1972. Michigan flora, Part 1—gymnosperms and monocots. Cranbrook Inst. Sci., Bloomfield Hills, Michigan.
- WEBER, W. A. 1961. Additions to the flora of Colorado. Univ. Colorado Stud., Series in Biology, No. 7:1-26.

(Received 10 August 1982; accepted 8 May 1984.) (See note added in proof, p. 59.)